

General Subjects Section
ACADEMIC DEPARTMENT
THE INFANTRY SCHOOL
Fort Benning, Georgia

ADVANCED INFANTRY OFFICERS COURSE
1947 - 1948

THE OPERATIONS OF AMMUNITION DEPOTS IN NORMANDY
FROM D-DAY TO THE BATTLE OF ST LO.
6 JUNE - 25 JULY 1944
(Personal experience of a Depot S-4)

Type of operation described: SUPPLY OPERATIONS IN
SUPPORT OF AN AMPHIBIOUS LANDING

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TABLE OF CONTENTS

	<u>PAGE</u>
Index.....	1
Bibliography.....	2
Introduction.....	3
Ammunition Supply Preplanning.....	3
The Assault.....	4
The Peninsular Campaign.....	10
Consolidation and Regrouping.....	12
The Break-through.....	19
Analysis and Criticism.....	19
Lessons.....	22
Map A - Line After Assault Phase: 11 June	
Map B - Line After Peninsular Campaign: 26 June	
Map C - Line Before Break-through: 25 July	
Photographs A and B	

BIBLIOGRAPHY

- A-1 Report by the Supreme Commander to the Combined Chief of Staff on the Operations in Europe of the AEF (TIS Library)
- A-2 Campaign Summaries (World War II)
Department of Military Art and Engineering
U.S. Military Academy, 1946 (TIS Library)
- A-3 Ammunition Supply Report by Lieutenant Colonel
A. C. Hutcherson, Ammunition Supply Officer, First
United States Army (Personal possession of author).
- A-4 Operation Report Neptune (TIS Library)
- A-5 Ammunition Supply and Operations, European Campaign
(TIS Library)
- A-6 First U.S. Army Report of Operations, Annex No. 13
Ordnance (TIS Library)
- A-7 First U.S. Army Report of Operations, 20 Oct 1943
to 1 Aug 1944 (TIS Library)
- A-8 History of Ammunition Supply Division of ASCZ,
By Lieutenant Colonel D. F. Shepard
(Personal possession of author)
- A-9 262d Ordnance Bn (AM) History (Personal possession
of author)
- A-10 Overseas Experiences of Service Units D 810.U201
(TIS Library)
- A-11 Report re Ordnance Equipment D 731.1.K91 #13
(TIS Library)
- A-12 Personal knowledge
- A-13 ADSEC in Action (Personal possession of author)
- A-14 Combat Operations Data, FUSA in Europe 1944-45
D 767.6.U112 (TIS Library)

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INTRODUCTION

One of the characteristics of service units is that when only a few are operating, the loss of one unit is a relatively large percentage of the total, and if as essential as ammunition supply, the situation may become critical. This was the case in Normandy in July 1944 when, during the mounting of Operation Cobra for the break-through at St Lo, a fire broke out in Ammunition Depot 101 threatening First Army with the loss of one-third of its reserve ammunition. From D-Day, ammunition had always been in tight supply, and often rationed. The beachhead difficulties and unusual hedgerow conditions that the infantry had to contend with brought its own set of obstacles for Ordnance in carrying out its mission of supplying ammunition to the using units "where, when and in the quantities required." Primarily, the tactical situation determined the supply picture, but mutually, the supply requirements influenced the tactics.

AMMUNITION SUPPLY PREPLANNING

Detailed preparation of the ammunition supply plan began on 1 February 1944. The extreme stringency of available tonnage lift and beach capacity required the most careful planning. All planned reserves had to be held at an almost dangerously low level, and the risk of loss by enemy action and accidents had to be accepted. A unit of fire was set up as the ammunition consumed in one day of intense combat, or 2½ days average combat. Actual loading of all craft began on 8 May, closely supervised by corps and division ammunition

officers. The light landing craft, such as LCT and LCV, when actually loaded held less quantities than planned, so that it was necessary to reduce the amount carried in the assault. Space had to be left for ammunition not on hand, such as 81 mm mortar, which was not available for loading until 25 May. (1)

THE ASSAULT

H-hour, D-day. 0630 hours, 6 June 1944. A year of combined detailed planning resulted in the successful cross-channel assault against the German armies. Amphibious forces of the A E F landed on two beaches of the Cotentin Peninsula as shown on map A.

Omaha Beach. The initial landing here was made by the 1st and 29th Divisions, who experienced the greatest difficulties. This was due principally to the unusual surf conditions causing heavy losses in personnel and equipment, the presence of an additional German division that had recently reinforced this section, and the difficult terrain. (2) As a result, their advance was costly in casualties and initially behind schedule. Each unit carried its basic load of ammunition, plus as much as their available lift permitted. During the day, only a small amount of supplies arrived, and these were just piled on the beach. By late afternoon of D-Day, the first preloaded DUKWs discharged their cargoes of ammunition in a small cleared field to form the first dump. Only individual initiative cleared mine fields, opened roads, unloaded supplies -- in short, organized the confusion until centralized control could function. All the time, troops, supplies and trucks poured into the beach, although there was hardly room for the expansion necessary.

(1) A-6, p. 69; (2) A-7, p. 41

By 0120 hours on D/1, the 5th Engineer Brigade had 200 tons of ammunition available at an emergency beach dump. The 251st Ordnance Battalion and its companies were to begin landings on D Day at H/ 60 minutes, but were delayed by heavy enemy fire, lost many vehicles and men, arrived at the wrong beach locations and were pinned down and dug in on the beach most of D Day. By D/1 they were reorganized and operating ammunition dumps as the situation required, since the tactical situation required a complete change from previous plans. Although late, the demand was also late so that no essential shortage occurred. (3) Later on D/1 two inland fields at beach exit F-1 were cleared of mines and sniper fire and the first emergency inland ammunition dump set up. In other sections of the beach, however, only beach dumps could be set up as the ammunition continued to arrive and the divisions needed resupply. On D/4, Army Ordnance assumed responsibility for ammunition supply from the Engineer Brigade and set up ASP 501 to supply V Corps. Until then, the following dumps were operated, located as shown on map A (4):

<u>Date Opened</u>	<u>Date Closed</u>	<u>Location</u>	<u>Type</u>
D/1	D/2	Between Exits E-1 and E-3	Emergency beach dump
D/1	D/2	Fields near Exit F-1	Emergency
D/1	D/3	Behind Easy Red	Initial
D/1	D/5	Easy White Beach	Emergency
D/2	D/17	Behind Fox	Initial
D/3	D/13	Dog White Beach	Emergency
D/4	D/16	Vierville	Initial
D/4	Permanent	Formigny	ASP 501

Dumps were as forward as possible, with the result that in one 6th Engineer Brigade dump the shells were carried by hand from the dump to the artillery batteries.

(3) A-3, p. 1; (4) A-4, p. 242

Utah Beach. Here the assault was much different. The 4th Division met with the least opposition of any landings, although it was here that the largest losses were expected. (5) The Ordnance Officer, VII Corps established ASP 701 on D Day (see map A); which was later taken over by the Army Ordnance officer for supply of ammunition to VII Corps.

Methods of Handling. All DUKWs and replacement trucks shipped to the continent were preloaded with supplies, ammunition having a high priority. These, plus LSTs, constituted the initial supplies. By D+1 the flow of ammunition arrived steadily via LSTs and dumb barges, and later by liberty ships. Boats that could beach were unloaded directly into trucks; others were unloaded into DUKWs by landing nets, which was the bulk of the supplies. On shore large efficient transfer points used cranes to transfer the landing nets with the boxes of ammunition to 2½ ton trucks that hauled it to the dump. This saved wear and tear and decreased turn-around time on the critical DUKWs. The DUKWs operated two ten hour shifts a day, with the remainder for maintenance -- out to a ship to be loaded with a landing net of supplies, back to the transfer point, then around the circuit again.

The primary emphasis of everyone was tonnage (6) and unloading ships; of lesser importance was what was moved and how. As a result, although the ships were originally loaded with each type of ammunition separated, it arrived at the dumps very mixed up. Often rations or other supplies would be mixed with the ammunition and vice versa, and every truckload would contain several calibers and types.

(5) A-1, p. 25; (6) A-5, p. 7

Time was not always available to unload trucks in the proper locations so that many loads were further mixed up. Cranes were used at the dumps to unload the cargo nets of mixed loads by emptying the net on top of a pile for later hauling to a storage field. At one time a pile of ammunition grew to 35 feet high and contained 1100 tons of ammunition. Some drivers would not wait for unloading but would simply tie the nets to a tree and drive off, pulling the load onto the ground. (7) Drivers of dump trucks would just dump the entire cargo on the ground and return to the beach for another load. Small and critical items were easily lost. Ammunition on hand which is impossible to locate or not inventoried might just as well have never been received; and vice versa, ammunition on records but not on hand gives a false reserve which may prove disastrous when needed for battle. Consequently the problem of control was most important. This was solved in one dump by dividing into three sections. Each section devoted one day to receiving, one to inventory and clearing up, and one to issuing. This prevented quick issues, ammunition was still stored in too many places, and did not work satisfactorily with the stock fluctuating rapidly. (8) At ASP 501 and 701, the first permanent depots, sorting bays were later set up where all trucks with mixed loads were unloaded. The ammunition was sorted by type and lot numbers and then loaded on depot trucks to go to the storage points. These sorting bays using assembly line roller conveyors for separating the ammunition were the key to successful operation of these two depots. Although

(7) A-12; (8) A-5, p. 7

this required many more men and trucks, it was more than made up for by the ammunition that was not lost and the time saved in issuing it. (9) All ammunition depots received and issued on a 24 hour basis, with the emphasis on "pleasing the customer". This required taking care of issues to the using units first, often sacrificing receipts and intra-depot rearrangements. Night operations proved to be much slower, less efficient and far more liable to errors than daytime operations, so that by the end of the night there were usually a backlog of several thousand tons to be sorted and moved to storage. The high production necessary under blackout conditions was not able to be developed. Perpetual inventory teams were one answer to accurate records, but not enough skilled checkers were available for this. Because of the shortage of military personnel the bulk of the labor was local civilians; and as a result, the normal truck crews of one non-com checker and four privates had to be broken down so that every private became a checker and was given a crew of five civilian laborers. With the low mental ability of some of the company personnel, this arrangement vastly increased errors in documentation, but there was no alternative if the ammunition was to be kept moving.

Storage Conditions. In contrast to storage conditions in the United Kingdom where an ample road net and adequate area was available, in Normandy the few good roads were overcrowded with combat troops and movement of other supplies so that storage had to be in the fields. With the enormous amount of troops and supplies in the beachhead, space soon became very limited, so that ammunition could not always be

stored in accordance with the safety tables. Some companies were bivouacked in fields containing several hundred tons of high explosive ammunition. (10) All the fields were relatively small, divided by hedgerows, small trees and ditches. Hedgerows had to be cut so that the trucks could go from field to field. At first, storage was under cover of the trees and along the hedges, but it was soon necessary to disregard cover and camouflage, and store throughout the field. The mud was bad during rainy spells, but trucks were able to use the dump at all times.

Enemy Activities. Although the heavily defended beach area had been thoroughly mined, with the rapid German retreat there were relatively few mines in the dump areas. Allied control of the air was so complete that no German planes attempted to bomb during daylight. (11) Luftwaffe planes came over the Beach Maintenance Area every night, but few bombs were dropped. One interesting target at Omaha was a dumb barge loaded with 500 tons of ammunition and 500 tons of gasoline that arrived on D/1 and was not unloaded until D/3. (12) The only damage at Omaha occurred when one 500 lb. H.E. bomb hit one corner of a field, blowing up about 15 tons of artillery and mortar ammunition. Snipers caused trouble early in the operations but were soon eliminated. Shortage of personnel did not allow enough soldiers to patrol the dumps completely. (13) Large quantities of enemy ammunition were captured, but could not be segregated, stored properly or utilized until the relatively static period late in September. (14)

(10) A-12; (11) A-4, p. 236; (12) A-4, p. 226; (13) A-4, p. 236; (14) A-5, p. 23

Ammunition Supply. On Omaha beach, the supply situation was initially very serious but eased up by 10 June. On Utah beach, at no time was there a serious shortage of ammunition. (15) The principal shortage was in small arms and hand grenades, caused by abnormally high expenditures in the close-in fighting of the hedgerow warfare. (16) This was relieved by air shipments of 300 tons of ammunition from the United Kingdom. Ammunition reserves grew satisfactorily until 19 June when a severe storm stopped all unloading across the beaches for three days, and slowed it up for several succeeding days due to damage to shipping, piers, and bridging, resulting in a serious setback to supply stocks. With stocks reduced, it was necessary to again fly in large quantities of ammunition from the United Kingdom. Air lift brought in 1500 tons of all calibers of ammunition in three days, which proved to be a most satisfactory method of supply. (17) Ammunition rationing to artillery had been imposed on 15 June, and was not relaxed until 4 July.

An attack of the 90th Infantry Division on 23 June was postponed because of supplies and additional restrictions on ammunition expenditures caused by this storm. (18)

THE PENINSULAR CAMPAIGN

The immediate objective of expanding the beachhead to permit the logistical buildup had been attained, but it was necessary to capture the port of Cherbourg to accommodate the vast stocks of war material required for future operations -- much more than the expected capacity of the beaches, especially in winter. (19) With this objective, the 9th

(15,16,17) A-6, p. 70; (18) A-5, p. 82; (19) A-1, p. 27

Infantry Division broke through the German lines to reach the west coast, and with the VII Corps attacking up the peninsula, Cherbourg fell on 26 June. Meanwhile, the V and XIX Corps extended their lines south of Omaha Beach, to the positions shown on map B.

As the infantry moved forward, ASPs were set up to push the ammunition forward to the using units. The general policy of having one army ASP to support each corps was followed, so that ASP 702 was established in the VII Corps sector (see map B). This ASP was strafed three times on 22 June and a 300 ton loss incurred by the resultant fires (20) ASP 801 was set up to serve VIII Corps on 20 June. At the close of the operation on Cherbourg and the removal of VII Corps from this area, stock in ASP 702 was shipped to 801.

In the Omaha sector, ASP 502 was established on 17 June. Afterwards, it was apparent that the V Corps advance would not continue as anticipated, and it was therefore necessary on June 21 to displace this ASP to the rear beyond light artillery range. Ordnance transportation moved 1500 tons of ammunition in 5 hours to ASP 503 (see map B) by means of tank transporters carrying 40 to 50 tons and other heavy Ordnance trucks. (21) This move formed the basis for later large movements of ammunition across France. ASP 1901 was established for XIX Corps on 18 June. During this period, Advance Section Communication Zone started operating. Personnel had arrived on D⁺3 and worked with Army units to be ready to take over installations as required. On 18 June, Advance Section took over complete control of beach operations.

(20) A-3, p. 1; (21) A-3, p. 2

CONSOLIDATION AND REGROUPING

During this period from 26 June to 24 July, ground was won for mounting Operation Cobra, the attack to break through the German lines. The Corps were grouped as shown on map C, and supply buildup pushed. There was no immediate threat to the security of the beachhead, but the First Army was reaching the point where the capacity of Cherbourg, the beaches and artificial ports would be inadequate to maintain it. It was imperative to open other ports, particularly in Brittany (22).

The 262nd Ordnance Battalion commanded by Lieutenant Colonel H. C. Holman arrived at Depot 100 (formerly ASP 501) on 3 July, while the 166th Ordnance Battalion operated Depot 101 (formerly ASP 701). This relieved the First Army units and permitted them to move forward. On 10 July Advance Section CZ took over operational control of these depots together with Depot 102 operated by army units. Operations during this period were seriously handicapped by the shortage of transportation, adequate storage area and the failure to open Cherbourg port for class V supplies (23). Depot O-510 was opened near Cherbourg (see map C) but only a small amount of ammunition was received there. The Germans had done extensive demolition in the port, so that large scale operations was not immediately possible.

All the services were operating on a relatively narrow strip of land along the beaches, so that every field in this area was used for bivouac or storage. Traffic was dense, especially in the neighborhood of V Corps beach where supply depots were astride the one major road, Route N 13. Lined up next to each other, starting from Formigny going west was a class I dump,

(22,23) A-1, p. 31

class V depot, a class III dump, Engineer depot, QM depot, Signal depot, Medical depot, truck assembly point and an air strip. Even with the acute storage problem, supplies continued to pour in. On 8 July, Depot 100 had 40,000 tons of ammunition; by 31 July this had increased to 75,000 tons. (24) With the enormous number of vehicles ashore, traffic was a major problem, consequently, the bulk of the ammunition was moved forward at night in convoys of truck companies.

Ammunition Supply. By 15 July expenditure rates had increased to the point where reserves were being depleted at the rate of .2 unit of fire per day, so the Army commander directed that expenditures be restricted by rationing. Lack of information on quantity of ammunition enroute to the theater probably caused undue restriction. This restriction was based on expenditure rather than issue. (25) Every corps was given a bulk allowance of each type of ammunition based on estimated activity during each four day period.

Deeper and wider concentrations than normal were employed to compensate for lack of observation in the difficult hedgerow country. Small arms and 81 mm mortar HE light ammunition were especially critical. To relieve this shortage, all vessels in the United Kingdom waters were called forward for off-loading, so that at one time there were 145,000 long tons of ammunition lying off the beaches waiting to be off-loaded. (26)

In general, supply discipline was good. However, some amount of the ammunition shortages was due to the infantry units. Nearly all troops entering combat requested more ammunition than they

(24) A-1, (25) A-6, p. 70; (26) A-8, p. 2

could carry, then dumped it when they realized it was more than needed. (27) Unauthorized reserves were carried at battery positions, and when the units had to pick up and take off leaving the ammunition behind, much of it was lost.

From 16-24 July, expenditures were less than the rationed amounts since the bulk of the artillery was held silent in new positions. The initial day of Operation Cobra, 25 July, and the next two days expenditures increased, but from then on were light and the exploitation required little artillery expenditures.

Special Problems. Lot numbers are of vital interest to the infantry. This is the major cause of artillery dispersion, which requires infantry to follow an artillery concentration at a distance of several hundred yards. During these early days, shipments of lot numbers arrived so mixed up that most issues of artillery ammunition had to be of unsegregated lots. (28) One ASP containing 7445 rounds of 105 shell had 308 different lot numbers. Palletized skid loads of 1½ tons were of some help in maintaining lot numbers.

Each ammunition battalion had a purchasing and contracting officer authorized to hire and pay all civilian labor required in the depot and buy necessary local supplies. Eventually, with the increase in depots of all services, and the limited labor pool to draw on, the different depots competed with each other in attracting labor. Various installations offered K ration lunch, C ration lunch, hot soup, free cigarettes, gloves, raincoats and other clothing for work, pay increases over the standard rates by subterfuges and other incentives. Ammunition depots were not too attractive for civilian labor because of

(27) A-10, p. 7; (28) A-12

the heavy loads and few interesting stocks to pilfer, but the civilians quickly learned the ammunition important to them; so that ammunition containing silk parachutes, such as illuminating mortar, had to be specially safeguarded. The labor turnover was high, work output low, but at a pay of about \$.15 an hour not much was expected of them. At Depot 100, the peak employment was 500 civilians, and the average weekly payroll \$3,000. (29)

As already covered, 12 July was relatively quiet, with primary emphasis on preparation for Operation Cobra. At Depot 101, the total stock of ammunition was 29,000 tons. An area containing about 4,500 tons of palletized ammunition stored en-masse had just been uncrated and stored in stacks with the proper safety distances between them. This solid block of ammunition had been a considerable worry to the personnel, because if there were any accidents like a fire or enemy bombing, this entire stock would have exploded, together with a large part of the countryside. The day before, Lt. Rhoades, then supervising the day shift at the sorting bay, made a speech to the civilian laborers to work hard with confidence that no harm would come to them now that this dangerous storage condition had been eliminated. Live salvage ammunition was normally disposed of by dumping at sea, but because of the shortage of DUKWs and other reasons, a large amount had accumulated near the depot stacks.

At 1445 hours on 12 July, a terrific explosion shook the salvage area. Several heavy detonations followed the initial blast, a stack of white phosphorous shells was hit spreading

(29) A-12

the burning phosphorous, and the fire was on its way. Explosions jumped across the hedgerows from field to field, setting off additional stocks of every type of ammunition up to 240 mm. Depot headquarters was immobilized by the first blast, together with communications. Two ammunition companies were bivouacked almost in the middle of the explosion, but fortunately almost all the men were out working. Many of the men from the night shift who were sleeping were killed. Everyone in the area evacuated as best they could with little thought given to fire fighting. With no fire plans prepared, personnel remained at a safe distance while plans were made and units reorganized. Not much fire fighting work could start until the nearest heavy equipment dispatched from Omaha began to arrive, which took four hours. Tank dozers and armored bulldozers went in first to pile dirt around and over the stocks to prevent further spreading of the fire. They did the main job in saving the rest of the depot from going up. After them, ammunition troops and engineer fire fighters were able to move in putting out burning phosphorous, pumping water over smoldering boxes, and moving some ammunition from the path of the fire. The fire was brought under control about 0130 hours the next day, just short of an area containing 450 tons of TNT. If this had gone off, the loss of men and supplies would have been much more. Photographs A and B are aerial photos of the fire taken before effective fire fighting started. This shows how the fire spread across the hedgerows to many fields. A large number of small fires are seen, started by the exploding HE and phosphorous shells. The cause of the explosion was never determined exactly, but was

believed caused by a truck dumping captured hand grenades and mines into an unserviceable pile of ammunition. All evidence, including personnel, went up in the explosion. (30)

What was the effect of this explosion on ammunition supply? Depot 101 was supplying VII Corps directly and VIII Corps through ASP 801. First Army Ordnance immediately based VII Corps on ASP 1901 already supplied by Depot 100, and ASP 801 directly on Depot 100. Thus Depot 100 was carrying the entire ammunition supply load for First Army. To maintain their stocks, every available truck in First Army was dispatched to Depot 100 to move ammunition, about 500 trucks arriving within a few hours. This operation started smoothly, but in the middle of the night during the confusion of changing shipping orders, the worst congestion of trucks ever seen occurred. Even at that, the depot handled 12,000 tons in that 24 hour period, an all time high. (31)

Actual loss of ammunition was about 1500 tons, aggravating an already unsatisfactory supply situation. While the loss was not good, there was little effect on any Infantry units as their trucks were directed to another source of supply and just required several hours longer for the trip. On the other hand, if this fire had not been brought under control so quickly, the entire ammunition supply of two corps, VII and VIII, would have been cut off and if not causing a catastrophe, it surely would have caused weeks of delay in again building up stocks to accomplish the St Lo break-through. (32) To the depot, the loss was serious in that the area was immobilized and operations curtailed at the expense of experienced men, invaluable records, communications and supplies.

(30) A-3, p. 3; A-12; Ord O, Ad Sec CA; Lt Rhoades;

(31) A-9; (32) A-3, p. 3

Since stocks were not balanced between depots and records were far from perfect, First Army Ordnance had a difficult job to keep their ammunition supply from stagnating. (33) Depot 101 resumed some receipts the next day, and issues the following day, after the sub-depots reorganized and inventoried. During this period the 262nd Ordnance Battalion operated Depot 100 with its own units consisting of 10 ammunition companies, 2 Quartermaster Service Companies, 1 truck company and Engineer Fire Fighters plus its civilian labor.

The following table summarizes expenditure figures by First Army on a few ammunition items during the period 6 June to 31 July: (34)

cal 30	71,800,000 rds		
cal 45	7,410,000		
60 mm Mortar	578,000	H E 97%	
		Illuminating 3%	
81 mm Mortar	842,000	Light 78%	
		Heavy 14%	
		Smoke 8%	
Rocket AT	99,000		
Grenade, Hand, Frag	514,000		
105 How	1,297,000	H E 96%	
		W P 2%	
		Smoke 2%	
155 mm How	363,000		
155 mm Gun	94,000		
4.2" Mortar	104,000	H E 65%	
		W P 35%	
Total Tonnage expended of all types listed above and not listed	107,860 Tons		

(33) Ordnance Officer, Advance Section CA; (34) A-6, p. 70

THE BREAKTHROUGH

The breakthrough was preceded by the most concentrated air assault yet employed in support of ground operations. Starting slowly on 25 July, the drive of VII Corps gathered speed, and with the advance of VIII, XIX and V Corps, the defensive line of the Germans was again broken. The rapid advance was made possible by the enormous supply buildup and the successful supply planning to push the required material to the front whenever, wherever and in the quantity required.

ANALYSIS AND CRITICISM

In spite of the large quantity of ammunition expended, after D+4 there was no very critical shortages of ammunition. There were many difficulties, some rationed periods and shortages in specific types even during adequate supply of tonnage, but over a lengthy period the expenditures were relatively low. For example, the following figures show the expenditures of rounds per weapon per day from 6 June 1944 to 1 January 1945. (35)

Carbine	0.4
Submachine Gun	1.9
Rifle, M 1	1.5
Rifle, Automatic	8.4
Machine Gun, Cal 30	32.5
Mortar, 60 mm	5.0

These figures include all weapons on the continent, whether in combat or rear areas, and indicate that from a higher level the ammunition supply problem is more distribution and transportation than quantity.

The time interval and the amount of rehandling of ammunition from the zone of Interior to the guns must be realized and appraised realistically. Just from a ship at the beaches to the using units, ammunition was moved by hand ten times or more. The

better organized and planned the ammunition supply system is, the less quantity is required to fill the pipeline.

Operations under enemy ground and aerial fire and under the hazard of ordinary operating conditions proved that with proper storage conditions, the ammunition depot is relatively safe from large losses due to explosions. Without the proper storage conditions, such as existed in Depot 101 and to some extent in Depot 100 on 12 July, not only were the lives of men and material endangered, but supply of vital ammunition was threatened. Bivouac areas, sub-depot and headquarter offices were located within the ammunition storage areas and close to the most dangerous of all spots, the salvage area. Enemy strafing proved more dangerous than bombing, but even there damage could be restricted to the area originally hit. An ammunition depot is an unprofitable target.

To minimize damage in case of fire, especially under tight storage conditions, ammunition companies must be trained and equipped to fight fires. In the United Kingdom, depots were dependent on local civilian firemen, and training consisted of having a few personnel read about fire fighting in a manual. Thus, when Depot 101 exploded, there was little evidence of the necessary aggressiveness and fire fighting knowledge that could have minimized the loss. Ammunition boxes begin to burn slowly, so that there is usually appreciable time after a stack starts to burn before danger of an explosion. This is the time for prompt and strong action. In addition, there was no equipment available, so that several hours were wasted while waiting for tankdozers and the like to arrive from the nearest point, ten miles over crowded highways. Tankdozers are well suited for

fire fighting, although the armored bulldozer is much better.

Increased dependence on air lift for emergency items would have spared much extra work due to disrupted schedules and conserved far more sea lift. During the time of ammunition shortages, it was often necessary to unload one hundred tons of various supplies to get to one ton of critically needed ammunition. In far less time and cost, the ammunition could have been air lifted from depots in the United Kingdom. The air lift available worked out very well.

Although much effort went into supplying artillery ammunition to the troops by lot numbers, it generally failed during this period. The principal difficulty was in the transportation. Although ammunition was loaded on the ships by lot numbers, with the emphasis at the unloading end on moving tonnage it usually arrived at the depots mixed up. Segregating it in the field and keeping it segregated when reserves are limited and demand is irregular proved to be impossible with any reasonable number of ammunition companies. More extensive use of palletized loads and larger lot numbers to begin with would have helped to solve this problem.

The DUKWs played a major part in moving cargo across the beaches. They were the only dependable means of moving cargo directly from ship to dump, and when trucks transported the cargo inland, made use of the beach very efficient. The Engineer Special Brigades did an excellent job in organizing the beaches to handle the maximum tonnage.

If more ammunition troops had been phased in the operations earlier, more effective use would have been made of the ammunition on hand. They were not needed as early as H₀/60 minutes, but

more were needed the afternoon of D Day. Much of the ammunition received at such high cost became unavailable because of the shortage of Ordnance troops in checking and inventorying the ammunition. The additional ammunition made available by several more Ordnance companies would have been very valuable to the using units.

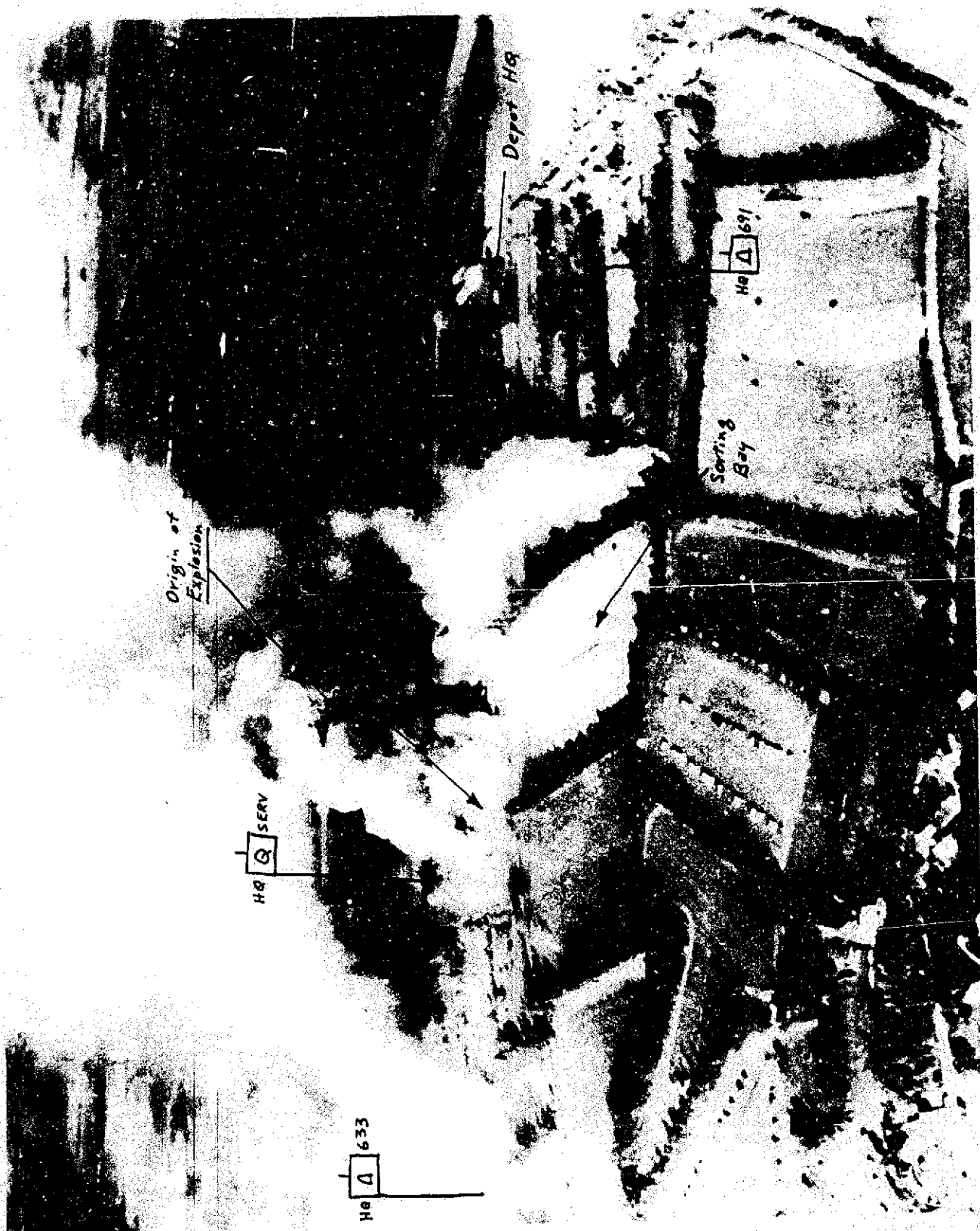
Civilian labor proved essential to depot operations. Initially when all the services were competing for labor, much damage was done to civilian labor relations. The labor supervision headquarters should have been operating much earlier to allocate labor to the various installations. In order to get out the required labor, it was necessary to offer inducements such as food, which was much more valuable to the French than money. All this should have been laid down in previous instructions.

LESSONS

1. The basic load prescribed was arrived at from combat experience and was adequate except in exceptional circumstances.
2. Ammunition supply is simple if you always know how much is on hand and where.
3. Ammunition troops must be trained and equipped to actively combat fires, even though in some personal danger.
4. Increased allowance for air lift is necessary in the early stages to fill critical shortages of specific types.
5. Ammunition troops must be carefully phased into the assault, and must land where planned.
6. For issuance of artillery ammunition by lot number, close control of every movement from the Zone of Interior to the using unit is necessary.

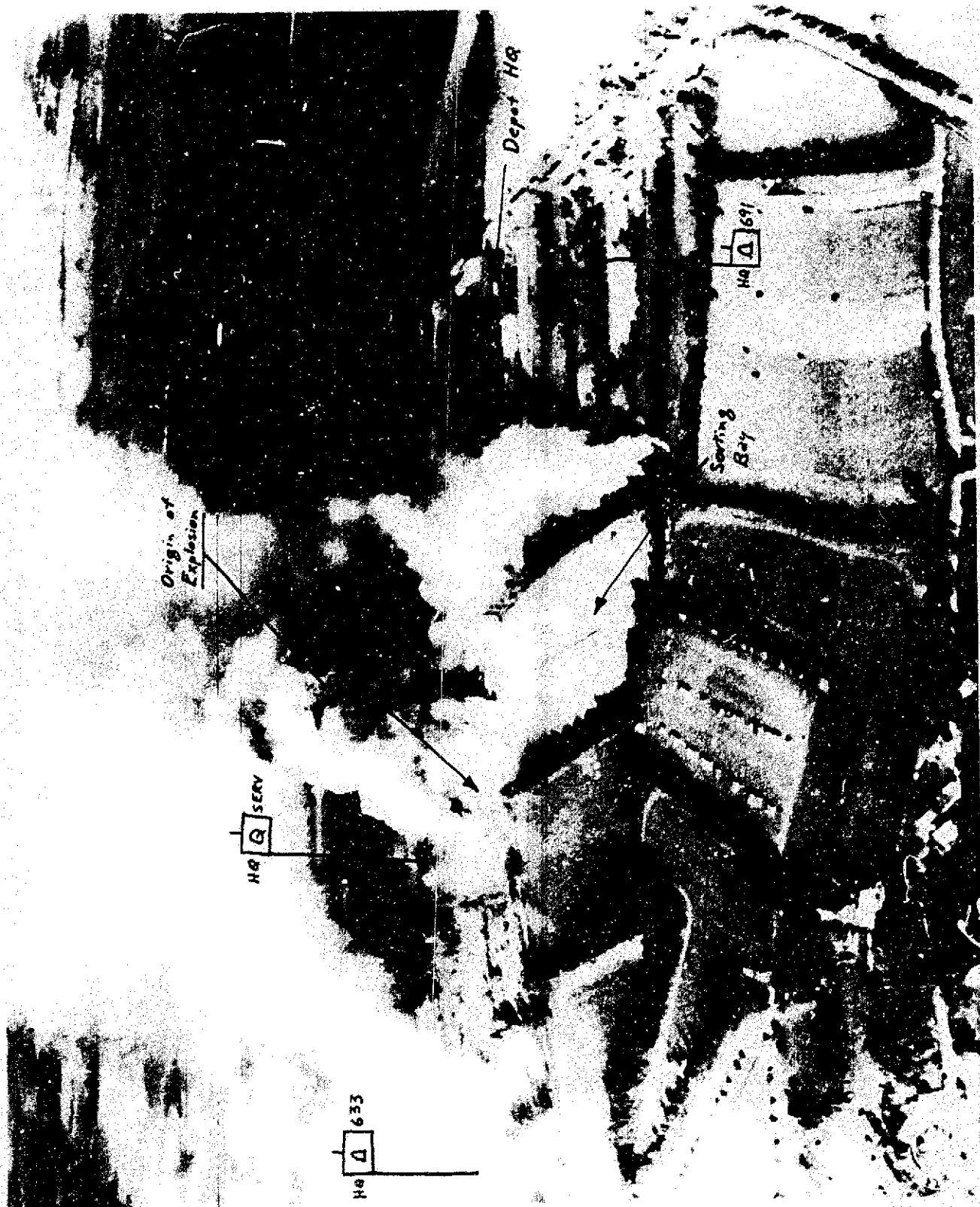
7. Local civilian labor is always necessary in depot operations, and must be planned for.

8. Early in landing when supply is critical and in one or two locations, infantry units must be as self-sustaining as possible.



PHOTOGRAPH A

Ammunition fire in Depot 100 on 12 July. Time about 1630. Ammunition can be seen stacked in many fields, and close to bivouac areas.



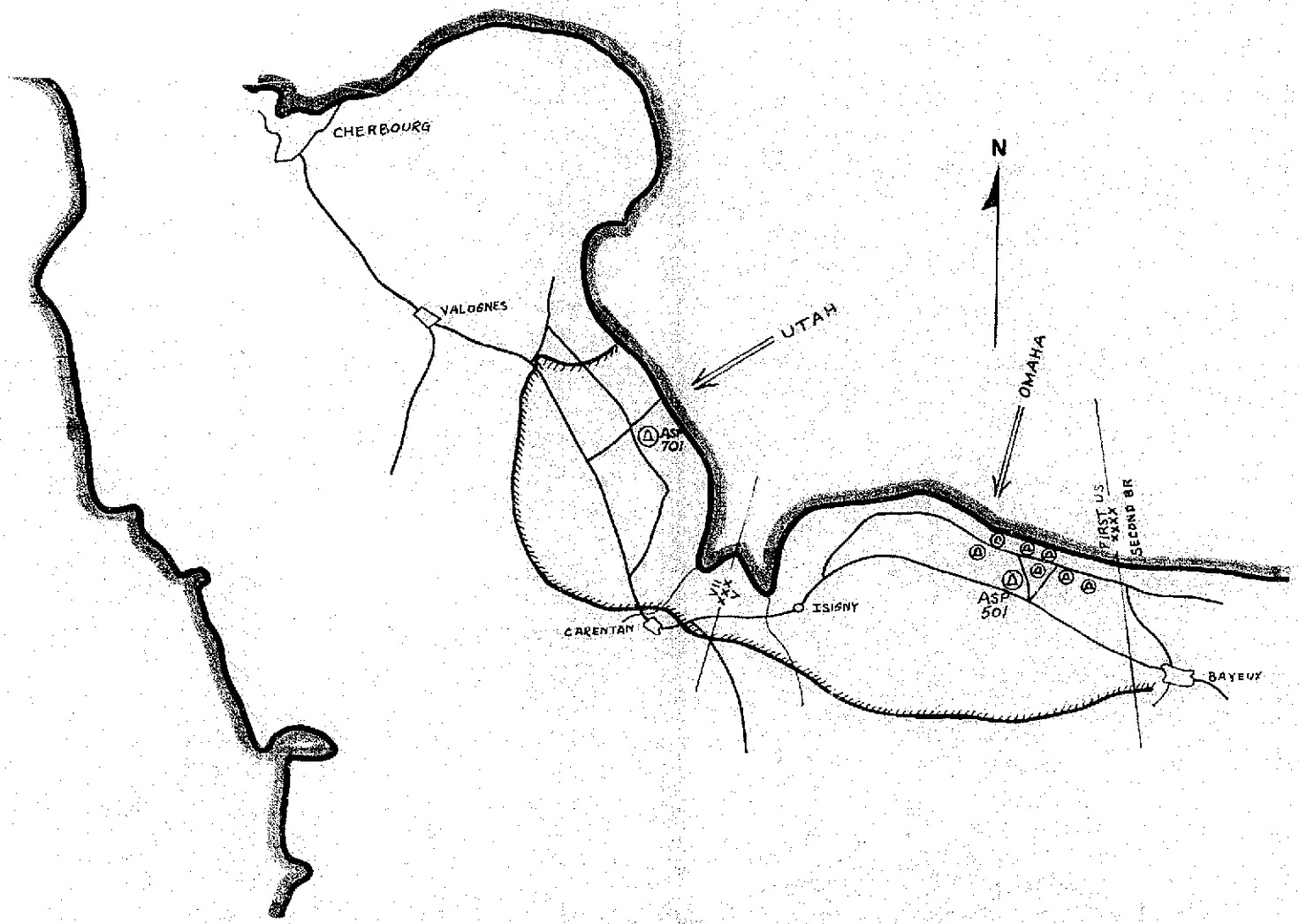
PHOTOGRAPH A

Ammunition fire in Depot 100 on 12 July. Time about 1630. Ammunition can be seen stacked in many fields, and close to bivouac areas.

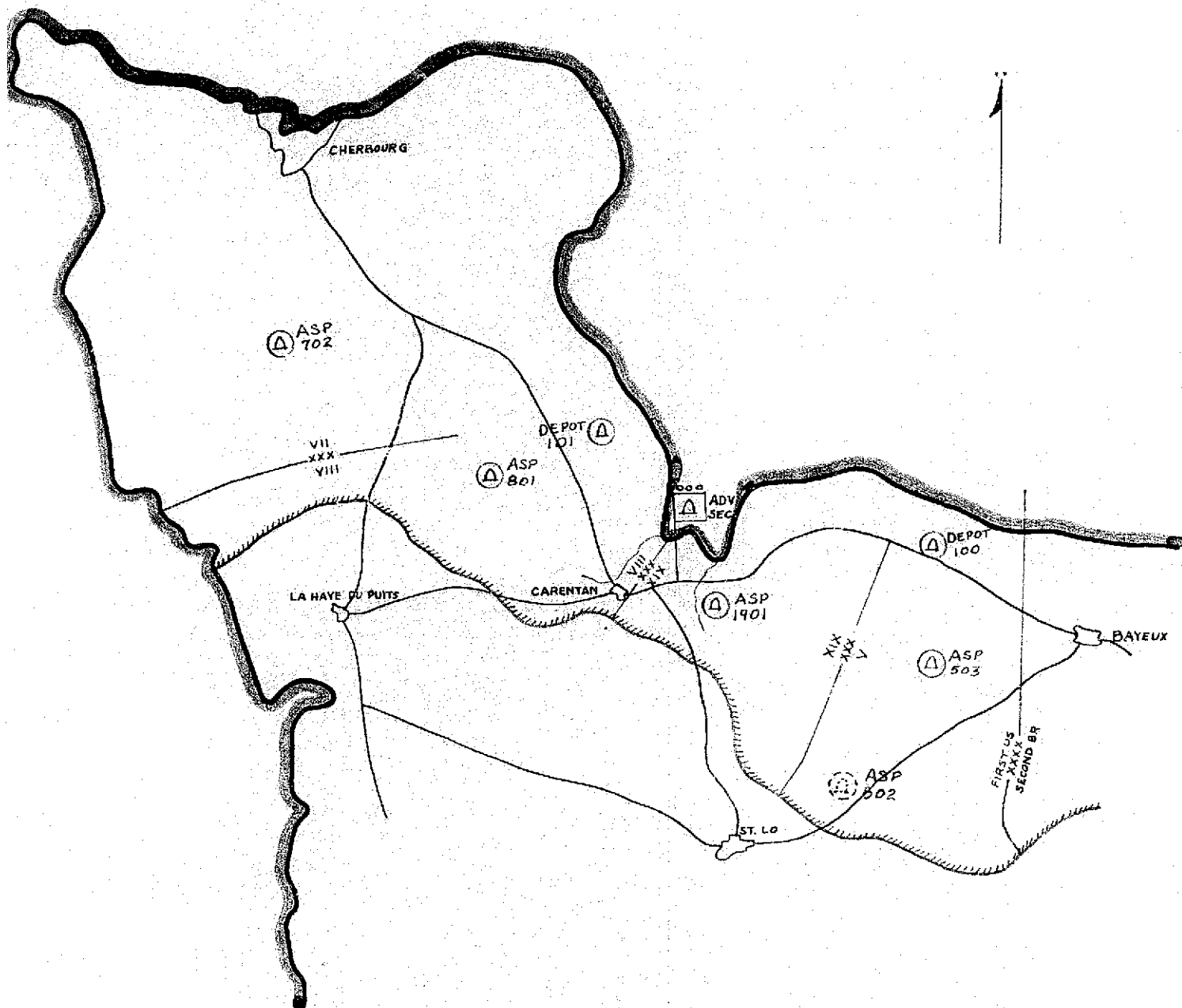


PHOTOGRAPH B

Different view of same area described on Photograph A.



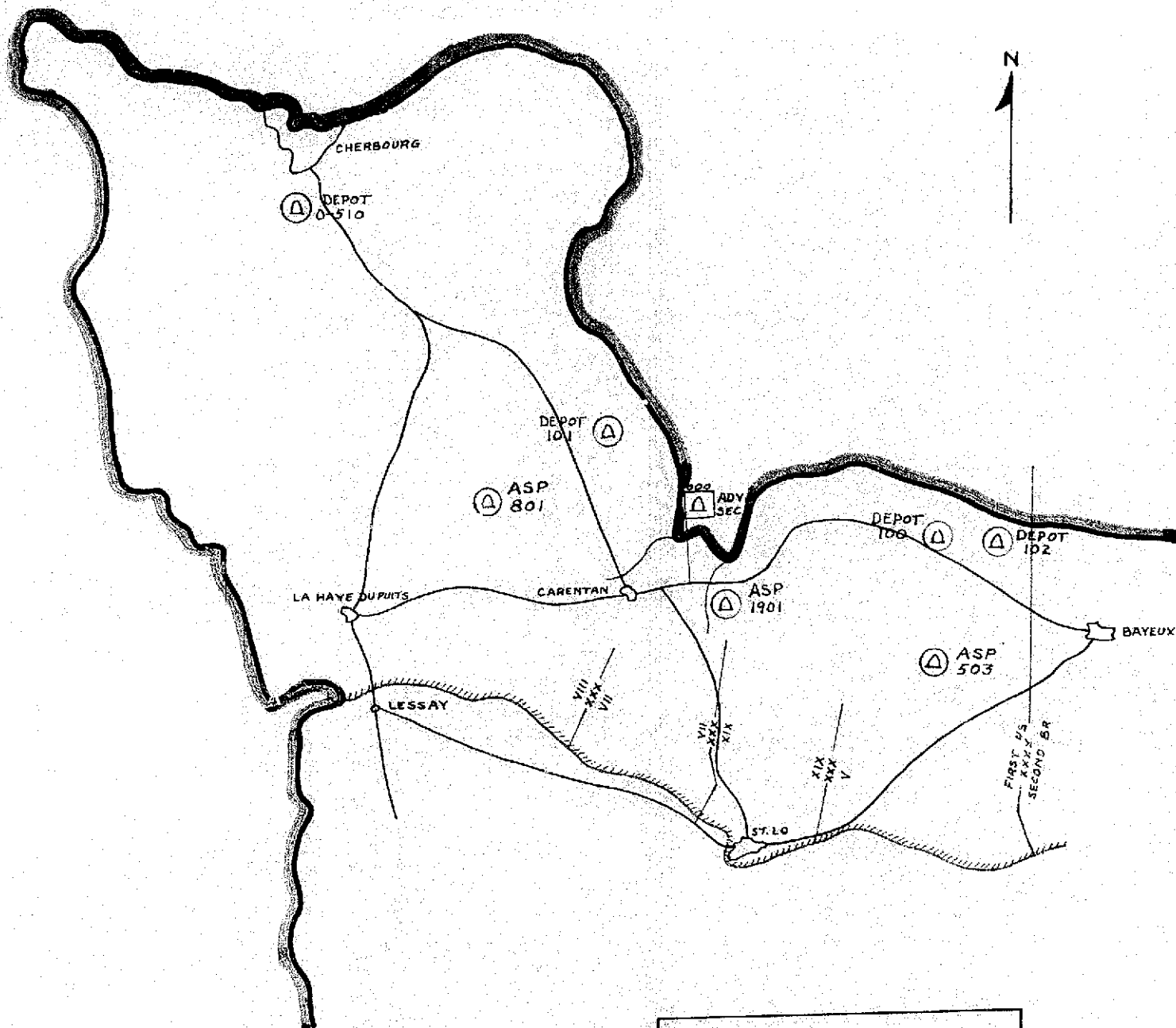
MAP A
LINE AFTER ASSAULT
PHASE 11 JUNE



MAP B

LINE AFTER PENINSULAR
CAMPAIGN 26 JUNE

5 0 5
MILES



MAP C
LINE BEFORE
BREAKTHROUGH 25 JULY

5 0 5
MILES